Cement MILL SECTION of

Concrete

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New Plant of the Virginia Portland Cement Corporation

Subsidiary of the International Cement Corporation—Unique Method for Washing Marl and New Gypsum Table Feeders Are Among Outstanding Features of the Newest Plant of the International System

The new plant of the Virginia Portland Cement Corporation, a subsidiary of the International Cement Corporation, located at South Norfolk, Virginia, was designed according to standards of the International System, which are well known in the cement industry. The International Corporation operates eight plants in the United States, one in Argentina, one in Cuba and one in Uruguay. In this case the plant lay-out was arranged to meet the local conditions, which included the consideration of transportation facilities for both the raw materials and the finished product. The design of the plant was governed by a careful consideration of the raw materials available.

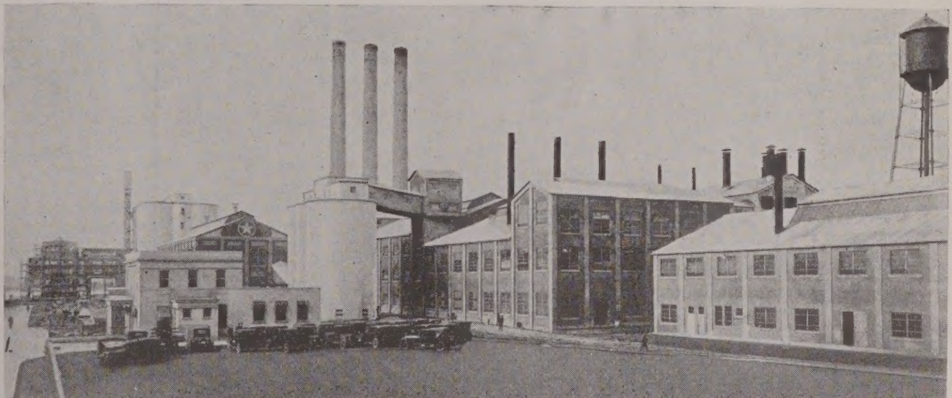
1,200,000 Barrel Capacity

The rated capacity of the new Virginia plant is 1,200,000 barrels of Lone Star cement annually. The raw materials used in producing the cement are marine marl delivered to the plant by water and clay transported to the plant by rail. Shell marl is obtained from the vicinity of Chuckatuck, Virginia, on the Nansemund—a tributary of the James River about 20 miles from the South Norfolk plant site. The marl is excavated with a Bucyrus drag line shovel with a 143-foot boom, loaded on 12-yard standard gauge dump cars and transported by rail to the washing plant on the bank of the river. There the excess sand, clay and iron oxide are removed by passing the marl through Dorr washers and classifiers, thence it is loaded on barges and transported down the river to the plant at South Norfolk.

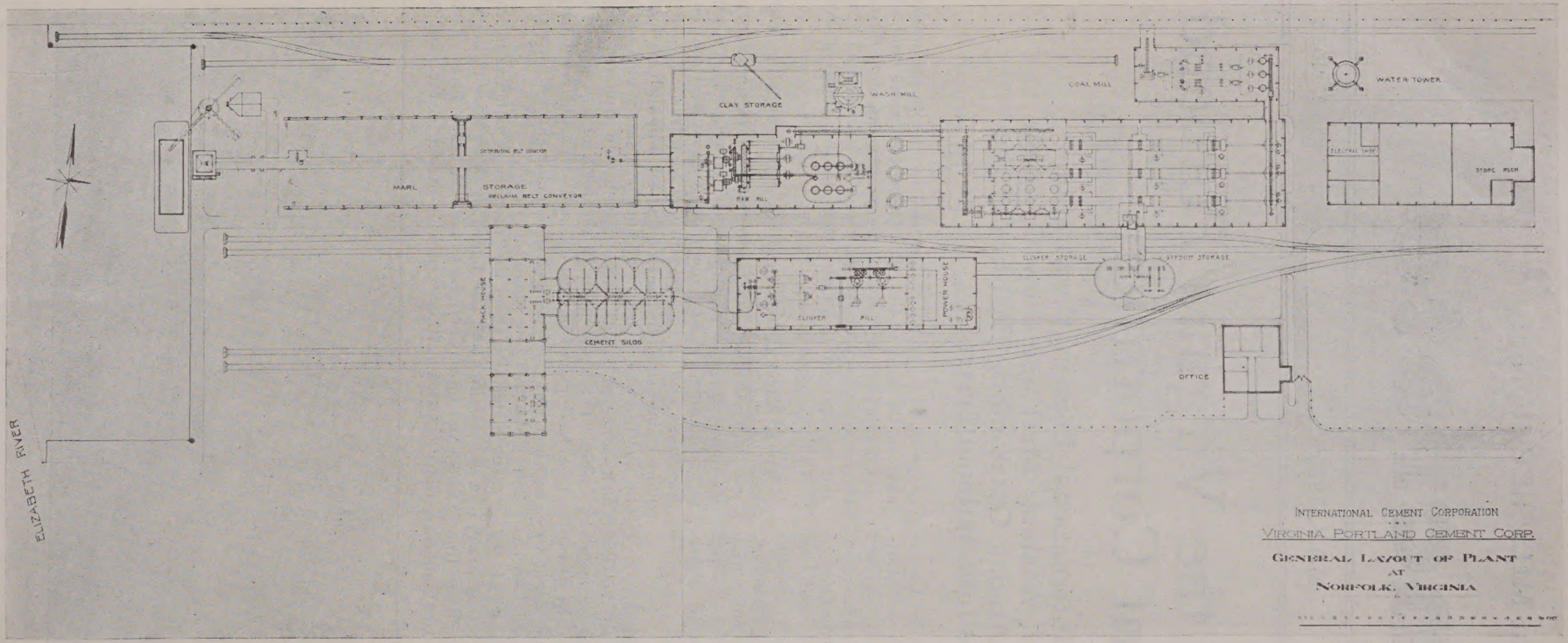
Novel Method for Handling and Preparing Marl

A more detailed description of the classification and washing process to which the marl is subjected was given in the January, 1926, issue of the Cement Mill Section of CONCRETE and is reviewed briefly as follows: From the hopper into which the marl is deposited by the cars loaded by the dragline, it passes through a hammer mill on to a belt conveyor which delivers it to the trommel of the washer. This trommel is in the form of a huge circular sieve, having half-inch holes, and is partially submerged in water, thus performing the double duty of separating and washing in one operation.

The material leaving the trommel is gathered by rakes in the classifier and is dragged by this device through the water and up an inclined trough. A heavy spray of clean water exerts a further scrubbing action on the marl as it

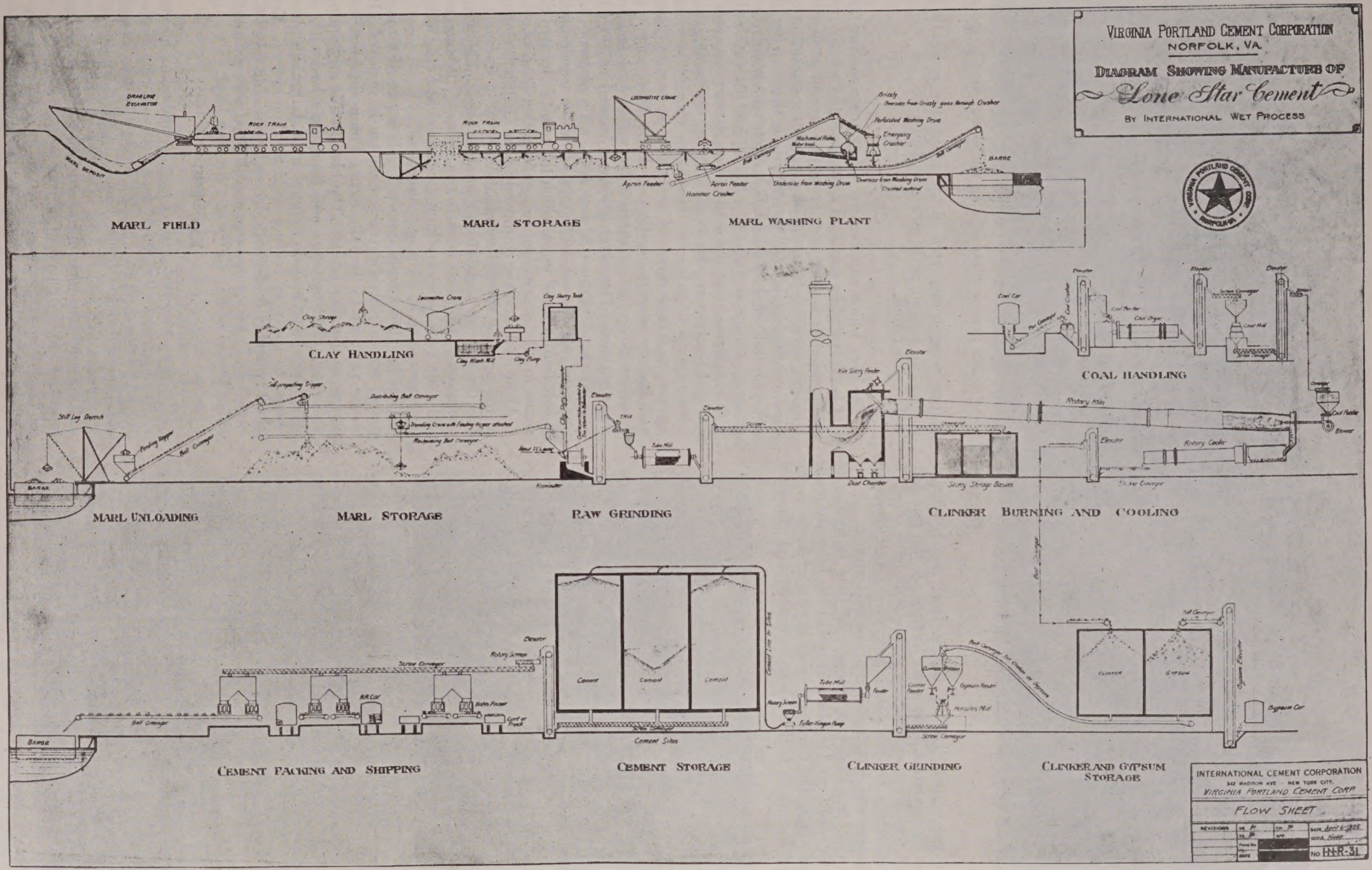


Plant of the Virginia Portland Cement Corporation with the office building and gypsum storage silos in the center foreground and the cement storage silos in the left background

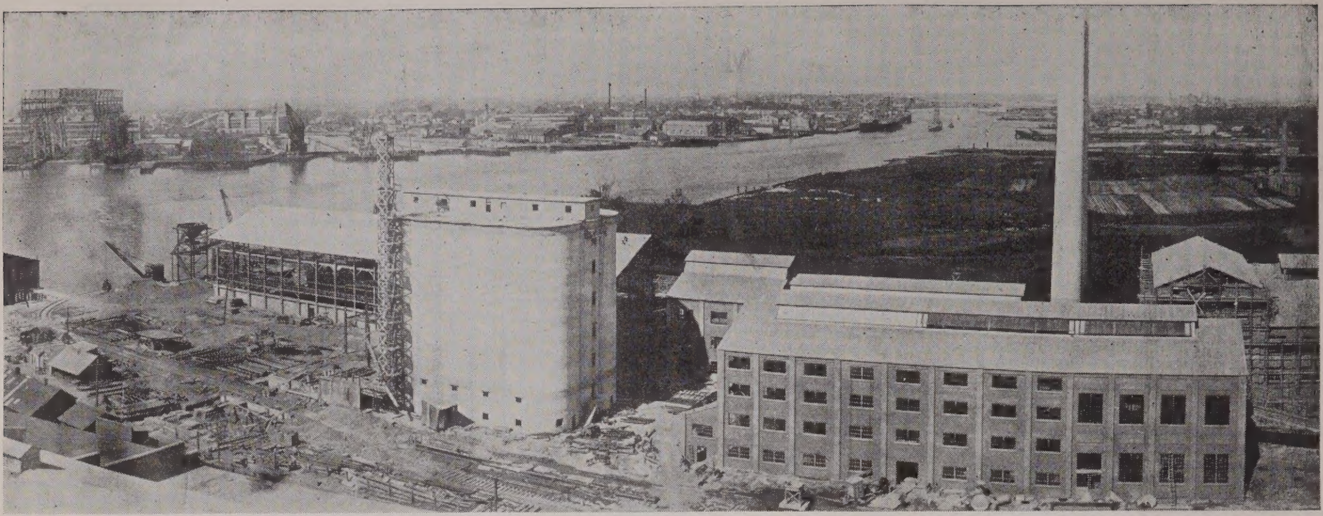


Plan showing the general layout of the plant of the Virginia Portland Cement Corporation at Norfolk, Virginia, a subsidiary of the International Cement Corporation. The compact arrangement of this plant, which is ideally located for rail and water shipments of raw materials and finished cement, is indicated by this plan.

A study of this layout and the flow sheet shown in another illustration will give a clear idea of the different steps in the manufacture of Lone Star cement by the International wet-blending process. The method of operation in the marl field and at the marl washing plant is clearly outlined in the flow sheet. The washing of the marl is one of the unusual features of this plant.



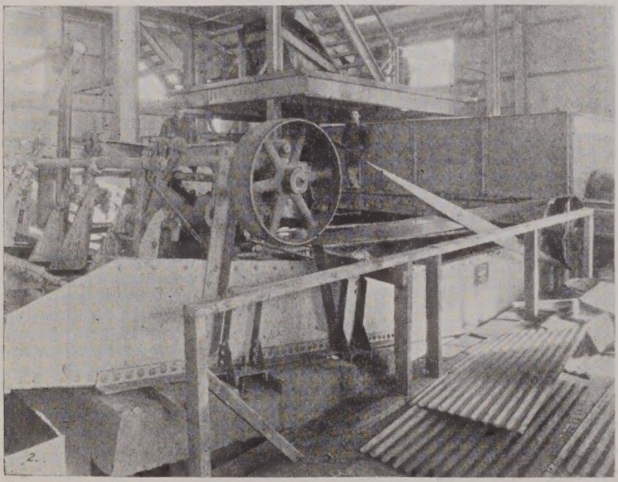
Flow sheet diagram showing the steps in the manufacture of Lone Star cement at the plant of the Virginia Portland Cement Corporation

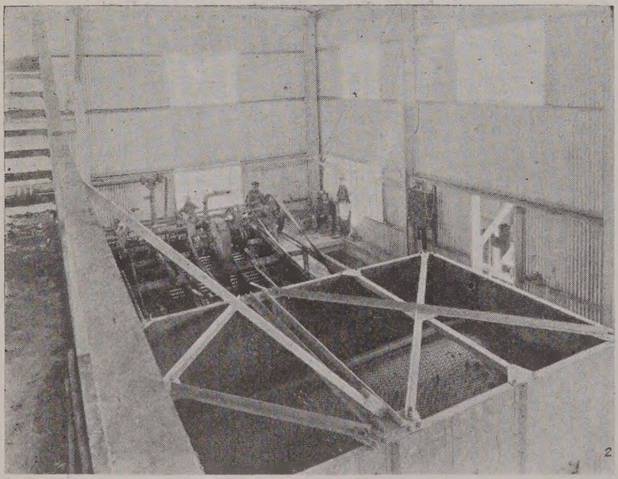


Panorama of the Virginia Cement Plant showing the arrangement of the units

reaches the upper part of the incline, which further cleanses the material. The water carries off the fine particles of foreign material, leaving a clean lime which is conveyed into a hopper discharging over a belt conveyor to the barges which transport it to the mill proper.

This shell marl used as a source of lime is similar to the oyster shells used as raw material at the International's Houston plant, and the most unusual characteristic is the fact that the marl at this plant is washed and classified before being transported to the plant, the ordinary procedure in cement mill practice being to use the raw material as found.





Interior views showing the Dorr washer and classifier

Clay

The clay which supplies the other principal raw material is excavated by means of a Browning locomotive crane equipped with a drag line, from the deposit at Waverly, Virginia, 60 miles from the plant, and transported in open cars over the Norfolk & Western railway direct to the plant site. It is unloaded by a Link-Belt electric-locomotive crane either to storage or direct to a No. 20 Smidth wash mill.

It is apparent that the outstanding characteristics of the site and location are the availability of raw materials, the advantageous shipping facilities to an adjacent consuming market, and indications of a steadily increasing demand and healthy market conditions. Lone Star cement produced at this plant is shipped by water, rail and truck transportation. The plant proper is located on the Elizabeth River. A channel 30 feet deep, with adequate wharf facilities, affords the advantage of water transportation. A belt line railroad upon which the plant is located gives access to all the principal railroads in that locality.

About 163 men are employed in the complete manufacturing process, divided approximately 30 in the marl pit, 3 in the clay pit and 130 in the mill proper. The men on operation of the plant work in two shifts of 12 hours each, while the yard gang, machine shop, marl and clay unloading crews work in shifts of 9 hours.

The clay slurry from the wash mill is passed through a coarse screen whereby foreign matter is removed. It is thence pumped by Buffalo Steam Pump Co. centrifugal pumps to the clay basins. The clay basins are equipped with mechanical agitators and from these basins the agitated clay slurry is again pumped by F. L. Smidth plunger pumps to the clay feeders over the kominuters. Ferris wheel type clay feeders are driven by variable speed G. E. motors and operate in a trough equipped with an overflow which keeps the clay slurry at a constant level.

Raw Mill

The marl unloaded at the plant is handled by means of a Milwaukee traveling crane to a belt conveyor discharging into bins over No. 85 Smidth kominuters equipped with standard rocker feeds. Each of the two kominuters is equipped with a No. 15 trix. The two No. 85 kominuters and three Smidth tube mills with the necessary elevators constitute the equipment of the raw mill.

Two kominuters are each driven by a 125 horsepower G. E. super-synchronous motor, and the tube mills are each

and the location of the plant with reference to rail and water transportation.

equipped with a 500 horsepower G. E. super-synchronous motor, direct connected, no magnetic clutches being required. The raw mill has the same standard equipment that has proved so efficient in several of the other plants of the International System.

Elevators and conveyors transport the slurry from the raw mill to the correcting basins. There are three correcting basins, each holding approximately enough slurry for 500 barrels of clinker. The slurry storage basins are also three in number and have a capacity of 1,250 barrels of clinker each. Both correcting and storage basins are equipped for mechanical and air agitation. The mechanical agitators are driven by 15 horsepower motors through speed reducers.

From the slurry correcting basins the slurry is conveyed to the kiln feed trough by means of a screw conveyor and elevators. The slurry is fed to the kilns by means of a feeder of the Ferris wheel type operating in a slurry trough maintained at a constant level.

The slurry as fed to the kilns contains approximately 38% of water, the necessary water to produce this consistency being added at the kominuters.

Three Kilns and Coolers

The burning is done in three Reeves Bros. kilns, 9 ft. by 8 ft. by 220 ft. long. Each kiln is equipped with an individual cooler. The kilns are equipped at both ends with air seals of original designs by International engineers. The kilns are fired with powdered coal, air for combustion being drawn through the coolers over the hot clinker discharged from the kilns.

Standard kiln liners are used without insulation and the kilns are each rotated by an individual 50 horsepower variable speed motor at a maximum speed of 1 revolution in 50 seconds.

The coolers discharge the clinker into an F. L. Smidth shaker conveyor, thence into an elevator to a 10,000 barrel clinker storage.

The coal used in firing as referred to above is received at the plant in hopper bottom cars, passed through a Jeffrey single roll crusher when necessary, thence to the dryers, and thence to the Fuller mills. The coal plant is equipped with two McKane dryers and a spray system to wash the discharged gases from the dryers.

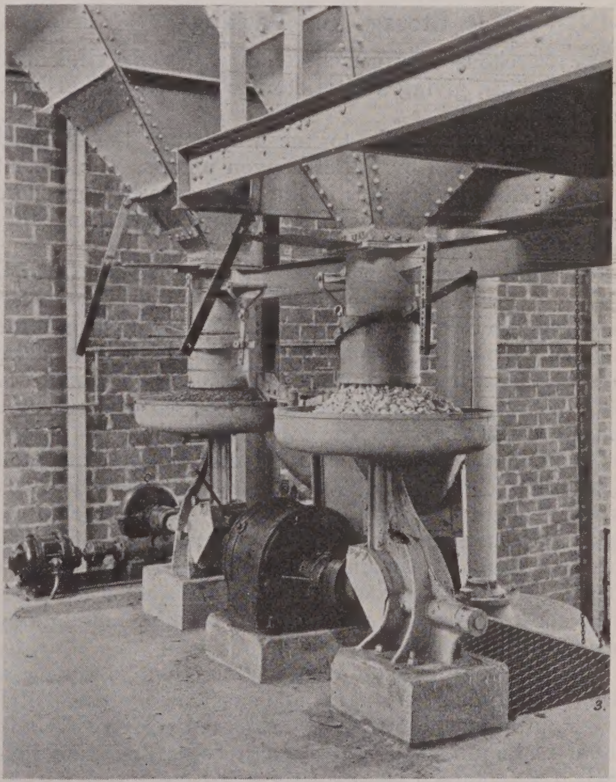
Plant Operates on Purchased Power

As electrical power to operate the plant is purchased from the Virginia Power & Light Co., no waste heat boiler installation has been provided and no auxiliary boiler plant is necessary. The plant power house contains the electric switchboard and the Ingersoll-Rand air compressors. All electrical equipment installed was manufactured by the General Electric Co.

The finish mill department is equipped with two Hercules mills driven by 300 horsepower super-synchronous motor and two 7 by 26 ft. Traylor tube mills each driven by a 500 horsepower super-synchronous motor. The Hercules mills are fed from overhead bins into which the clinker is dumped by an inclined belt conveyor from beneath the clinker storage. The finish mill is equipped with cyclone dust collectors.

The required amount of gypsum is handled by belt from the gypsum storage to a bin over the Hercules mills and is fed together with the clinker by means of a table feed on the Hercules mills.

With quality of product uppermost in mind at all



Clinker and gypsum feed to the grinding mills times, the engineering staff of the International System is constantly studying every step in the process by which Lone Star cement is manufactured.

The latest development which is of interest to cement users is a newly perfected feeding device which insures accurate proportioning and mixing of clinker and gypsum. This new device, shown in an accompanying illustration, is now in operation in the Norfolk and Kansas plants. That it results in a greater degree of accuracy and uniformity is apparent from this description:

General practice in mixing gypsum and clinker is to weigh each separately, mix and convey it to large feed bins over the first finish grinding machines, which are then fed by gravity. The tendency of the materials to segregate was the problem which presented.

International engineers have now perfected a novel method by which the mixing of gypsum and clinker becomes a continuous process and the proportion of either material can be regulated to a very high degree of accuracy.

The apparatus consists of two standard flat-top feed tables, which are in effect revolving discs. The materials are fed to these tables through telescopic feed pipes from overhead bins. The discharge from the feed tables is controlled by diagonal scraper cut-off knives.

Three distinct adjustments lend to the refinement of the process:

1. Height of telescopic feed pipe above table.
2. Speed of revolution of tables, which can be regulated independently of each other.
3. Angle of scraper cut-off knife.

The quantity of material fed from the bins is governed by the height of the open end of the telescopic pipe above the feed table, thus controlling the size of the pile of material resting on the table.

The relative speed with which the two tables move controls the proportion of the two materials to each other.

The angle at which the cut-off scraper knives are set gives quantity control of discharge from the revolving table.

Storage and Packing

The warehouse for cement storage has six silos with interstice bins, giving a total storage capacity of 110,000 barrels.

From the tube mills to the warehouse the finished cement is conveyed by Fuller-Kinyon pumps. The cement is reclaimed from the bins in the warehouse by conveyors and elevators which deliver it to the bins over the packing machines.

Four Bates packing machines are installed for loading cars and two for truck loading. The returned empty bags are handled by elevator to the upper floor of the bag house and thence to a continuous bag cleaner. The pack house and bag house are equipped with Sly dust collectors to keep them free from cement dust and to conserve the cement that would otherwise be wasted.

The laboratory is equipped with standard apparatus and in addition contains a 200,000 pound Universal Olson testing machine for making compression tests. In employing the International wet blending process in the manufacture of cement, continuous tests for quality make up an integral part of the process, and the laboratory exercises strict control over the product, the chemist maintaining constant supervision.

A machine shop maintained at the plant is equipped with a hydraulic press, punch and shear, two lathes, drills, planer, pipe machine and key seater, all driven by individual G. E. motors. A blacksmith forge and numerous small tools complete the equipment for making repairs to the plant machinery whenever necessary.

The plant buildings in which the machinery is housed are all of steel frame and cinder block covered with stucco. They were erected by the International Corporation's own forces after designs by the International engineers, preliminary construction work having been started in November, 1924.

The first cement was produced on November 9, 1925, one year after beginning the construction work, and production has continued uninterruptedly since. The quality of the product rather than the desire to produce cement at the earliest possible date was the main consideration, and the operating results have proved that the exhaustive study of the raw materials was justified. The plant has been in operation for a sufficient time to demonstrate that all refinements and unusual features work satisfactorily as planned.

Officers of Virginia Portland Cement Corporation are: H. E. Hilts, manager; Dwight Morgan, sales manager; George S. Winther, superintendent; H. A. Williams, chief chemist.

The Causes of Discoloration of Clinker

By H. H. BLAISE

General Superintendent, Great Western Portland Cement Co.

The discoloration to which the article in the April number of CONCRETE, entitled "The Causes of Discoloration of Clinker" refers has often been seen by the writer and he has formed the opinion that clinker discoloration of this type is as a rule caused by fuel contamination.

That it is fuel that causes the color noticed is proven by the fact that if natural gas or oil is used no yellow clinker will be formed either by direct air cooling or by quenching. In the article referred to, the use of more air is pointed to as a means of removing the trouble in that case but since the author failed to state how much air he had at first and the velocity of this air, the statement probably means little or nothing. To bring out this point, if an experimental test be tried starting with 100 per cent of the air required for burning and propelled at a high velocity, it will be found that the outside of each clinker is perfect in texture and color. This using coal for fuel, of course.

Examination of the inside of the clinker will reveal a large proportion of yellow centers, particularly if the coal be a trifle dirty or full of sulphur and impurities. If then the velocity of the air is still further cut, and manifestly the distance to which the powdered coal is propelled is likewise diminished, a point will finally be reached where the outside of the clinker will be somewhat yellow and the centers darker.

At even the point of balance between high and low air where the clinkers are uniform in color, and if the clinkers be quenched in water, a yellow color will appear and the strength and quality of the resultant cement will be directly affected by the amount of dirt and contamination which has been propelled into the kiln with the fuel. If at the same time natural gas or oil is substituted for coal, the color disappears at once. It is the writer's opinion that the cement is affected to a worse degree by propelling the dirt far into the kiln since this enters the mix at the time of forming the clinker. Manifestly material embodied chemically with the clinker is much more disadvantageous than that embodied physically or after fusion.

As relief from this trouble, provided the air mixture with the fuel is correct a clean coal is recommended. Contamination is generally present in all coal burned clinker to a greater or lesser degree but is only brought to our attention by rapid quenching.

Poor fuel is, in our opinion, the reason for most discoloration and also a large share of unsoundness.

The Cost of Low Power Factor

Part I

A Discussion of Power Factor in Cement Mill Power Transmission Systems from a Dollars and Cents Basis

By C. H. SONNTAG

This article dealing with the financial side of questions relative to low power factor and its cost will appeal to the managing executive of the cement plant as all considerations are put on a monetary basis. It differs from the ordinary descriptive article in that it deals with the financial side of the questions presented, and will be a guide to the man who thinks in terms of dollars and cents. Theory and mathematics have been reduced to the minimum required to bring out the vital points.

The writer concludes that it is apparent, even without bringing out every item that is affected by low power factor, that improvement in power factor is worth careful analysis since it may and probably will result in an actual increase in earnings.

Part 2 will be presented in the June issue of this journal.—Editors.

The question of low power factor in the transmission systems of cement mills and its possible correction are matters that are coming more and more to the fore. Some engineers prefer to locate the generating station a few hundred feet away from the rest of the plant so that the high grade machines in it may not be so severely exposed to the all-pervasive dust. The building of larger mills and the expansion of existing ones make the transmission of large blocks of power at moderate voltages a serious problem. The constant pressure for reduction in operating costs makes it imperative to get the last bit of production from every piece of equipment. The penalties for low power factor found in many contracts for purchased energy make the possible saving in that respect a very tangible thing. A little consideration of the nature of low power factor and its effects on manufacturing costs is hence well worth while from a dollars and cents standpoint.

What Is Power Factor?

Power factor is a term used to describe certain phenomena occurring in alternating current circuits. In its last analysis it is a mathematical conception, and it is difficult to present a correct mechanical analogy to it, but for practical purposes its meaning may be arrived at in this way:

In a direct current circuit the power being expended is measured directly and exactly by the product of the current flowing (in amperes) and the impressed voltage. Written mathematically,

$$W = V \times A \qquad (1)$$

Where W is the rate of doing work, in watts,

V is the voltage across the power-consuming device,

A is the current flowing, in amperes.

Exactly the same relationship holds between these quantities in a single-phase alternating current circuit containing neither inductance nor capacity if A and V are the effective values of the current and voltage respectively, as measured by suitable instruments.

A two-phase or quarter-phase circuit consists of two single-phase circuits supplied by the same generator and having constant time relations to each other. These two circuits may or may not be electrically connected, but when used for power transmission both enter the same motor, and both are usually equally loaded, each doing half of the total work. Hence the power being expended in such a circuit may be written

$$W = V \times A \times 2 \qquad (2)$$

Where W has the same meaning as before,

V is the voltage across either circuit,

A is the current flowing in either circuit.

For our present purpose a three-phase circuit may be defined as three inter-connected single-phase circuits using successively the wires of a three-conductor system. Since all the single-phase circuits do not always have the same amount of energy flowing in them at any one instant, we can not get the total power by taking three times that of one circuit, but it has been found that the number 1.73 is the ratio of the total power to that of any one of the single-phase circuits. We may then write

$$W = V \times A \times 1.73 \qquad (3)$$

Where W is the total work,

V is the voltage between any two of the three wires,

A is the current flowing in any one wire.

The number 1.73 is the square root of 3.

Those of the equations given above that are applicable to alternating current circuits are true only when these circuits contain neither inductance nor capacity, or contain them in amounts that will just neutralize each other.

Since radio sets have become as common as Ford cars, the terms inductance and capacity have lost some of the mystery that once surrounded them in the mind of the non-technical reader. The circular, spider-web or basket-weave coils used to tune the antenna and the circuits inside the set are inductances. The condensers that are also parts of radio hook-ups are used because they possess electrical capacity. Electric motors are made up essentially of inductance coils, of course much larger and more powerful than those used for radio. The iron which surrounds the coils or around which they are wound greatly increases their inductive power.

When a rapidly alternating voltage is impressed across a circuit containing inductance the resulting current acts as if it were made up of two parts, one of which is used to develop magnetism in and around the coils and the iron present, if any, while the other part does work by producing mechanical motion if conditions permit it to do so. This last is the only useful effect of the total current, but is done by only a portion of it. It follows then that in an inductive circuit the work done is less than that figured from the current flowing. We may express this by using a suitable factor or multiplier in either of the power equations for alternating current circuits. If we indicate this factor by the letter p we have

For single phase circuits, $W=V\times A\times p$ (4)
For two-phase circuits, $W=V\times A\times 2\times p$ (5)
For three-phase circuits, $W=V\times A\times 1.73\times p$ (6)

A value for p that will apply universally can not be given, since it is not a constant and depends on the amount of inductance and capacity in the circuit. This quantity p is the power factor of the circuit in question. It can obviously never exceed unity, but may have any lesser value down to practically zero.

It can be proved that that portion of each current impulse that is used for magnetizing purposes lags a small but real interval of time behind that which does external work. For this reason a fractional power factor caused by the presence of inductance in the circuit is said to be lagging, and the greater the lag the lower the power factor. The condition just described exists in the circuits of all induction motors, both squirrel-cage and slip-ring. It is inherent in the design of these motors that the power factor goes down with a drop in either horse-power rating or speed, and quite rapidly in the smaller sizes.

It was stated above that a portion of the current was uselessly employed in developing magnetism in and about the coils and their associated iron. If this magnetism is supplied by some other source, as by an auxiliary direct-current generator, it will not be necessary to use a portion of the alternating current for this purpose. If as much magnetism is developed by the direct current as would otherwise be created by the alternating current all of the latter will be available for external work, and the power factor will be unity or 100%.

An alternating current motor needs only a certain amount of magnetism in it to enable it to do its work. If this is supplied by an auxiliary direct current it is possible to develop more magnetism than the motor needs. A certain portion of the alternating current will then be devoted to opposing this magnetism and reducing it to the proper quantity, and will not be available for external work. In this case the power factor is less than unity. This is the condition in the circuit of an over-excited synchronous motor, and equations 4, 5 or 6 will apply.

It can be proven that that portion of each current impulse that is used in opposing excessive magnetization leads the part that does external work by a small interval of time. Hence a fractional power factor caused by an over-excited synchronous motor is said to be leading, and the greater the lead the lower the power factor. In practice the power factor of a synchronous motor may be fractional and lagging, unity or fractional and leading, depending on the strength of the excitation.

If the two sides of a circuit of reasonably high voltage, say from 440 up, are connected to two large metallic surfaces separated from each other by a thin layer of some insulating material, current will flow into these surfaces or plates until they are charged to the line voltage. If this voltage is alternating, current will rush into and out of the plates, charging them first in one direction, then in the other. It can be proven that in such a circuit the impulses of current lead those of the impressed voltage by an interval of time corresponding to almost one-fourth of a complete cycle. The power factor is a small fraction, but is leading. The device is called an electrostatic condenser, and is exactly similar in principle to those used in radio work.

The power factor of a synchronous motor doing no mechanical work is very low and leading. Because its effect on the power factor of the circuit to which it is connected is similar to that of an electrostatic condenser, a synchronous motor running idle and used only for power factor correction is sometimes called a synchronous condenser.

Without attempting a rigid analysis, it may be said that if two equal electrical loads with equal fractional power factors, one leading and one lagging, are connected to the same source of current, the leading and lagging components will neutralize each other and the resultant load will have unity power factor. For less simple cases, where there may be several loads at different power factors, the result of combining them is best worked out graphically. The capacity of the apparatus needed to bring the power factor to any desired value may be found in the same way.

The Cause of Low Power Factor

On long high tension transmission lines the power factor may be low and leading at light loads, because the wires act as the plates of a condenser. The circuits around cement mills are at moderate voltages and carry heavy currents, so that in them the condenser action is negligible, while the magnetic effects consequent on the high amperage must be carefully considered.

The electrical load of a cement mill is made up entirely of motors, except for the small percentage used for lights, and that is not large enough to have any material influence on the power factor.

The motor load is roughly divisible into two parts—one, the larger, made up of motors driving the principal grinding machines, air compressors and waste-heat fans, and the other group composed of motors on dryers, kilns and small fans, and also all those on auxiliary drives, such as elevators and conveyors.

The large motors in the mill are usually carefully selected as to size for the work they are to do, and by the very nature of that work they are, as a matter of good operating practice, kept fully loaded. The machines they drive are either self-limited as to the power they will absorb, or else particular pains are taken to see that the load is kept at a safe maximum by adjustment of the driven machine. Under these conditions the power factor of these large motors is quite high, and if the generators in the power house could operate at the same power factor as that of the large motors the incentive to install special apparatus for power factor correction would largely disappear.

Fig. 1 is a curve[1] showing the power factor at various loads of a 75-h.p., 500-r.p.m., 440-volts, 3-phase 60-cycle vertical squirrel-cage motor of the type that has been developed to drive 42-in. Fuller mills and 40-in. Griffin mills. At rated load its power factor is 83%. This particular machine is several years old and very liberally rated as to temperature rise. If built today it would undoubtedly be called a 100-h.p. machine, as it has often carried that load. At the higher rating its power factor is 85%, which is excellent considering its low speed. Larger motors will have still better characteristics. For instance a 375-h.p., 60-cycle, 580-r.p.m. slip-ring machine should have a power factor of 87 to 88%. Fig. 1 also shows how rapidly the power factor of even a fairly large induction motor falls off as the load is reduced. In this case the value at three-fourths load is 78%, and at half load only 68%.

Selection of Motors for Cement Mills

Most of the small motors of a cement mill are selected on a different basis as to size from the larger ones. For instance, a certain elevator may take 10 h.p. in normal operation, but the time may come when the chain will be a little slack and the buckets will drag, or there may be a sudden rush of feed filling the boot. If power enough to pull the elevator through this crisis is instantly available a shut-down may be avoided. A screw conveyor may wear down in its bearings and drag in the trough, or may for a few minutes have such a load as to almost bury it, and may take twice its normal demand for power. If a complete choke-up and shut-down does occur, plenty of power will permit things to get started again without cleaning the last bit of material out of the boot or trough. The saving of time and labor in such cases is of real value, and so all such machines are apt to be over-motored. The elevator that seldom demands over 5 h.p. will be fitted with a 10-h.p. motor. The conveyor that could usually be driven with a 15-h.p. machine will be supplied with one rated at 25 h.p.

There is a tendency also to use slow-speed motors on these auxiliary drives. This trend was in evidence when belt transmission was standard, for the belt running on the small pulley of a high-speed motor was a continual source of trouble. The manufacturers of speed reducers list them for connection to 900-r.p.m. motors, and even higher speeds are offered, but the conservative engineer will be more apt to use them at 720 r.p.m. in the interest of continuous service.

The influence of the speed on the power factor of small induction motors is shown in the curve,[2] Fig. 2 (b), from which it may be seen that one running at 1800 r.p.m. will have a power factor well over 90 per cent, while for one designed for 450 r.p.m. this will be about 72 per cent at full load. These small machines are seldom called upon to exert full load torque, and it will be perfectly fair to take power factor values at 60 per cent of rating. Here that of the 1800 r.p.m. motor is still 90%, while that of the slowest has fallen to 60 per cent. That of the motor likely to be selected will be about 70 per cent, but the average cement mill will have many small motors developing less than half a rating except for brief intervals.

The underloaded induction motor is here seen to be the prime cause of low power factor in the electrical systems of cement mills and similar industries.

The Cost of Low Power Factor

The influence of the power factor on the cost of manufacture appears in one or more of several ways, the principal ones being:

(a) The price paid for purchased power.
(b) The cost or capacity of electric generators.
(c) The cost or capacity of transmission lines.
(d) The cost or capacity of transformers.
(e) Excessive voltage drop at the ends of lines.

All of these hinge directly or indirectly on the increased current in amperes required to carry a given amount of energy in kilowatts at low power factor over what the current would be if the power factor were unity, for in carrying a certain load in kilowatts at a fixed voltage the current varies inversely as the power factor. The evil effect of this increased current is almost entirely due to the heat it generates in the apparatus through which it passes.

The ability of an electrical device to generate or transmit energy is limited by the temperature to which its parts are raised thereby and, other things remaining constant, this temperature rise depends only on the current flowing, in amperes, and not on the voltage or wattage. It follows then that when we buy a generator or transformer, what we pay for, among other things, is the ability to radiate or otherwise dissipate a certain amount of heat. The useful work represented by this heat depends directly on the power factor.

(a) The Price Paid for Purchased Power

The cost to a central station of the energy it sells is made up of two parts—first, that depending on the investment necessary in order that the station may be ready to furnish power at all times, and second, that depending directly on the actual energy delivered. Their charges to their customers are therefore a composite of these two, and the relations between them vary with the character of the load.

The second item may be dismissed with a few words, since it is not under the control of the customer after the price has been agreed upon and the contract signed. It is based on the cost of fuel to the central station, the cost of boiler water treatment, and such minor charges as are proportional to the power actually generated. Many contracts contain a clause varying the charge per kilowatt in some ratio to the delivered price of coal above or below a certain figure.

The first item may be looked at in this way. When a central station signs up to deliver power to a customer it must, at least in theory, set aside a certain portion of its equipment, or a certain part of its capacity, for the express purpose of being ready to supply this particular customer whenever called upon to do so. The fact that most or all of the equipment was installed before the contract was signed does not vitiate the argument. Interest, de-

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[1] Wagner Electric Corp., St. Louis, Mo.
[2] C. W. Drake, *The Electric Journal*, July, 1922.

FIG. 1

Power Factor and Efficiency
75 H.P. 514 r.p.m. 60 Cycle Motor

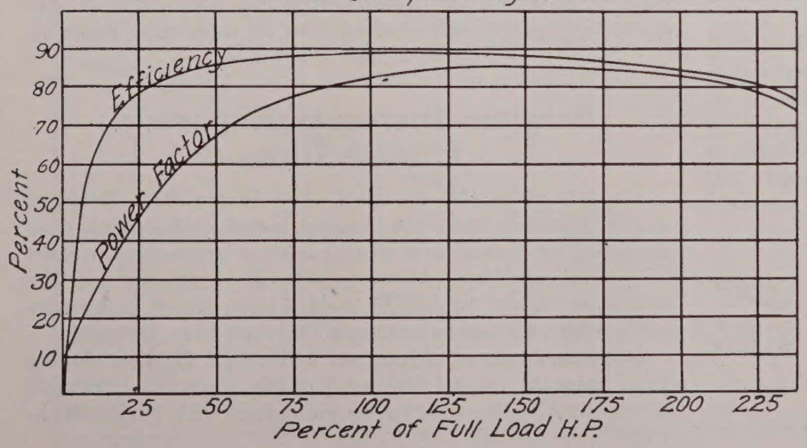
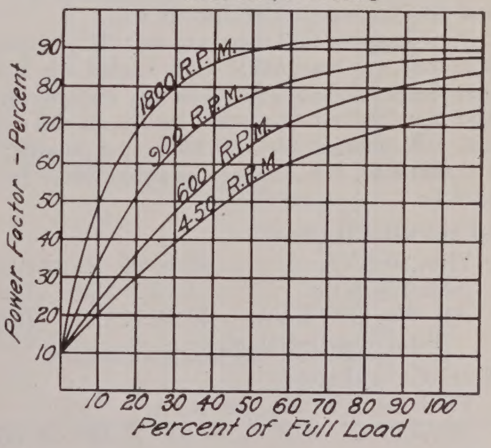


FIG. 2

Power Factors of 60-Cycle
Induction Motors



preciation, amortization, taxes, obsolescence, maintenance—some or all of these are chargeable against the equipment supposed to be set aside for each customer in proportion to his probable demand, and may be called a "readiness-to-serve" or "demand" charge.

Now the capacity of much of this apparatus is limited by the current in amperes that it can safely carry. This is true of generators, switchboards, transformers and tranmission lines. The true energy that can be delivered then depends on the power factor, going down as the latter decreases, though the load in KVA. may remain constant. It follows that the higher the power factor the more actual kilowatts can be generated or transmitted by given apparatus, and if a low power factor load is to be carried the size of the equipment must be proportionately increased.

Consideration of these facts has caused central stations in most instances to divide their charge into two parts, one based on the maximum KVA. demand, which depends on the highest energy demand in a certain period and its power factor, and the other depending on a summing up of all the actual energy delivered as measured by an ordinary wattmeter.

On small loads the peak of KVA. demand is frequently assumed at some arbitrary figure that will be near the truth, but in selling a large block of power, especially for a motor load, the utilities company is apt to install a recording KVA. demand meter which will show the highest KVA. drawn from the line during any set period, usually 15 to 20 minutes.

To show the effect of these things on the cost of purchased energy, let us take as an example an actual contract for a small power supply to an ice plant. The rate schedule is as follows, insofar as it concerns the present discussion:

DEMAND CHARGES.

For each KVA. of the first 50 KVA. of monthly maximum demand	$24 per year
For each KVA. of the next 150 KVA. of monthly maximum demand	$21 per year
For each KVA. in excess of 200 KVA.	$18 per year

PLUS ENERGY CHARGE.

For each of the first 150 KW. hrs. consumed per month per KVA. of monthly maximum demand	1¾c per KW. hr.
For all KW. hrs. used in excess of the above	1c per KW. hr.

MINIMUM MONTHLY BILL

shall be the monthly demand charge and no bill shall be based on less than one-half the maximum demand experienced during any one of the twelve months preceding.

The demand charges may be considered to be $2, $1.75 and $1.50, respectively, per month.

Now suppose that there are 400 HP. in motors installed, that they are reasonably well loaded but not overloaded, that the maximum demand in any one month is 325 KVA. and that 24-hour operation results in the consumption of 225 KW. hourly for 720 hours per month, or a total of 162,000 KW. hrs., and let us figure what the monthly bill will be.

DEMAND CHARGE.

First 50 KVA.	$2.00 × 50	$100.00	
Next 150 KVA.	1.75 × 150	262.50	
All over 200 KVA.	$1.50 × 125	187.50	
Total demand charge		———	$550.00

ENERGY CHARGE.

First 150 KW. hrs. per KVA. Demand	$.01 ¾ × 150 × 325—$ 853.13	
Balance—$.01 × [162,000 — (150 × 325)]	1132.50	
Total energy charge		$1985.63
Total power bill		$2535.63

In studying these figures two or three things become apparent—first, that the demand charge is an important part of the bill; second, that 24-hour operation leads to a reduction in the cost per KW. hr. consumed; third, that each KW. hr., instead of costing about 1 cent, as would be assumed at first, actually costs $2535.63 ÷ 162000 = 1.56c.

Under the third clause in the contract, if the plant is operated only one day in the month but a maximum of 325 KVA. demand is registered for that day, the full demand charge of $550 will be collected, plus the cost of the energy used on that day, provided the demand is not less than half that in any one of the twelve months preceding.

Since these motors are fairly well loaded, the resultant power factor is about 80 per cent. Let us calculate what the monthly bill would be if the power factor were 100 per cent, brought about by using synchronous motors or otherwise. The maximum demand would be 325 × .80 = 260 KVA.

DEMAND CHARGE.

First 50 KVA.	$2.00 × 50	$100.00	
Next 150 KVA.	1.75 × 150	262.50	
All over 200 KVA.	1.50 × 60	90.00	
Total demand charge			$452.50

ENERGY CHARGE.

First 150 KW. hrs. per KVA. demand	$.01 ¾ × 150 × 260	$ 682.50
Balance	$.01 × 162000 — (150 × 260)	1230.00
Total energy charge		$1912.50
Total power bill		$2365.00

We have here reduced our monthly power bill by $170.63, and this summed up for the year would go far toward making up the difference in cost between induction and high power factor motors.

A contract for a large block of power such as would be needed for an entire cement mill might not be as complex as the example just used, but it is reasonable to believe that the utility company will have the matter of power factor in mind in making the price it offers, even though it is not specifically mentioned, either directly or as KVA. It would be wise therefore for those contemplating the purchase of power to ascertain what reduction in its cost may be obtained by insuring that the load shall always be at high power factor when near its maximum demand.

(To be concluded in June issue)

Belgium Increases Exports to United States

Exports of cement to the United States from Belgium during February were the heaviest monthly shipments ever recorded, according to consular advices to the Department of Commerce from Antwerp. Total shipments for the month amounted to 52,525 metric tons, which represents an increase of approximately 6,000 tons over January.

Belgium's cement shipments to foreign markets during 1925 were of record volume for the country: 1,300,736 metric tons were exported, as compared with 1,059,996 in 1924.

Great Lakes Corporation Makes Progress

The accompanying illustration shows the proposed layout of the plant of the Great Lakes Portland Cement Corporation, Buffalo, N. Y., details of the organization of which were given in the April issue of this journal. The new company, whose shipping facilities will give access to 11 Buffalo steam railroads as well as motor truck lines and boat shipments, has let contracts to the Burrell Engineering and Construction Co., Chicago, for the buildings and docks.

Limestone to supply the plant will be transported by boat to Buffalo from the quarry at Rogers City. Shale will be switched into the plant from Shaleton, N. Y., nine miles from the mill. Coal will be secured from the Pittsburgh district.

The company has purchased four kilns 11 feet by 250 feet and four clinker coolers 9 feet by 90 feet from the Reeves Brothers Co., of Alliance, Ohio; grinding machinery from Allis-Chalmers Co., Milwaukee, Wis., including compeb mills 8 feet by 30 feet for both the raw and finishing end of the mill; coal pulverizing machinery from the Raymond Bros. Impact Pulverizing Co., Chicago, Ill. A contract has just recently been closed with the Fuller Co., Catasaqua, Pa., for Kinyon cement pumps for handling the bulk cement.

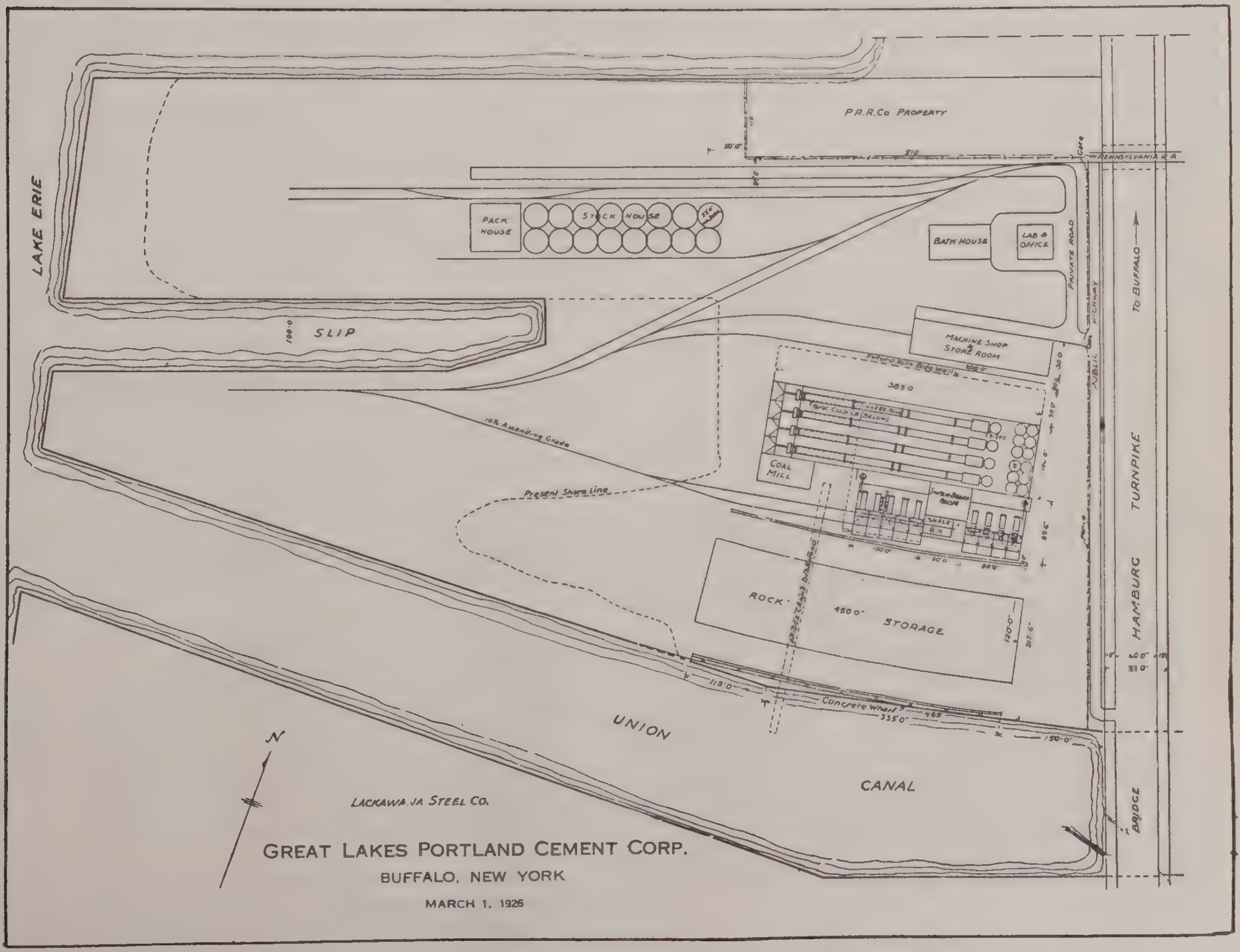
A 42-inch gyratory crusher purchased from the Allis-Chalmers Co., to be installed at Rogers City, Mich., and having a crushing capacity of over 2,000,000 tons per year will enable the company to go into the stone market. There is a tremendous amount of high calcium limestone used on the Great Lakes which market the company will be able to reach at a very low transportation cost.

Cement Rate to Arkansas Suspended

Operation of proposed revised rates on cement from points in Kansas and Missouri to Arkansas destinations on the St. Louis-San Francisco Railway were suspended by the Interstate Commerce Commission until July 29 pending investigation of the reasonableness of the revision. The new carload rates were filed to become effective March 31, as published in Supplements Nos. 5 and 34 to Agent F. A. Leland's tariffs I. C. C. Nos. 1772 and 1638, respectively.

The effect of the revision is seen in the following: The present rate from Chanute, Kans., to Lowell and Starks, Ark., is 13½ cents per 100 lbs. and the proposed rates on these destinations 14 and 15 cents, respectively. The present rate to Fort Smith is 16 cents and the proposed rate 15½ cents.

The Manitowoc Engineering Works have just completed the building and shipping of two rotary coolers, 5 ft. by 50 ft., and one rotary kiln, 8 ft. by 150 ft. to the U. S. Gypsum Company at Genoa, Ohio. The second kiln, 8 ft. by 150 ft. is now being built and will be shipped to the same destination in about two weeks.



GREAT LAKES PORTLAND CEMENT CORP.
BUFFALO, NEW YORK
MARCH 1, 1926

Geology of Formations Used in Cement Manufacture

With Particular Reference to Rock Strata in Missouri and Michigan

Geology of Jackson County, Missouri—Part 2

By P. F. BALFOUR

The following table is a section showing the analyses of the formations, including the materials, used in the manufacture of portland cement in Jackson County, Mo., by the Missouri Portland Cement Co., a more complete description of which appeared in the April, 1926, issue of this journal.

	Thickness	V.M.	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	$CaCO_3$	$MgCO_3$
Iola Limestone	12 ft. 0 in.	—	—	—	0.94	—	—	97.42	0.52
Chanute Shales	50 ft. 0 in.	7.35	52.21	7.26	22.67	1.63	2.30	—	—
Raytown Limestone	6 ft. 0 in.	—	—	—	2.96	—	—	93.96	1.40
Cement City Limestone	8 ft. 0 in.	—	—	—	1.07	—	—	91.04	1.52
Drum Limestone	9 ft. 0 in.	41.15	4.52	—	3.23	49.00	1.33	87.36	3.81
Cherryvale Shales									
Shale	17 ft. 0 in.	9.45	54.94	6.38	21.82	3.11	2.46	—	—
Limestone	1 ft. 6 in.	37.96	8.14	1.44	4.00	45.50	1.59	—	—
Shale	2 ft. 0 in.	20.02	30.60	4.51	12.35	19.15	3.18	—	—
Limestone	1 ft. 6 in.	38.04	9.36	1.72	4.88	42.19	3.54	—	—
Shale	7 ft. 0 in.	13.44	51.90	4.99	14.41	9.63	2.57	—	—
Winterset Limestones									
Limestone (Argillaceous)	12 ft. 0 in.	27.14	31.46	2.49	6.81	29.96	1.75	—	—
Shale	1 ft. 3 in.	7.00	63.10	5.76	16.46	0.97	2.61	—	—
Limestone	1 ft. 6 in.	40.18	8.46	2.18	2.58	35.26	11.39	62.69	23.92
Limestone	2 ft. 0 in.	40.10	7.00		1.58	49.68	2.12	88.71	4.45
Limestone	2 ft. 0 in.	36.50	12.38	1.36	5.35	36.98	6.20	66.03	13.02
Limestone	3 ft. 0 in.	41.80	2.70		1.66	53.02	1.68	94.68	3.52
Shale, Gray	0 ft. 6 in.	10.12	55.88	4.89	18.15	4.06	3.67	7.25	7.70
Limestone	5 ft. 0 in.	37.66	9.76	2.76	2.98	44.04	2.92	78.64	6.13
Shale	0 ft. 3 in.	12.44	51.02	4.23	16.89	7.64	2.37	13.64	4.7
Limestone grading to Shale	1 ft. 3 in.	—	—	—	—	—	—	—	—
Galesburg Shales									
Carbonaceous Shale	2 ft. 0 in.	14.90	5.08	4.57	17.73	3.96	2.86	7.07	6.00
Gray Shale	2 ft. 0 in.	8.64	62.86	3.61	18.13	2.44	1.92	4.00	4.03
Bethany Falls									
Limestone, Shaly Conglomerate	2 ft. 0 in.	31.60	19.72	2.97	6.93	38.12	1.30	68.07	2.73
Limestone, massive	21 ft. 0 in.	41.74	3.30		2.00	53.36	0.73	95.29	1.50
Ladore Shales									
Carbonaceous Shale	4 ft. 0 in.	19.44	44.08	4.20	17.08	7.30	3.10	—	—
Limestone	1 ft. 4 in.	41.58	2.42		2.38	51.74	1.52	—	—
Shale	0 ft. 7 in.	21.00	38.16	3.20	12.52	17.11	3.14	—	—
Limestone	0 ft. 5 in.	36.40	12.20		6.08	42.28	2.21	—	—
Shale	2 ft. 6 in.	10.14	54.20	7.30	15.32	6.17	2.98	—	—
Hertha									
Limestone	8 ft. 2 in.	41.60	2.70		2.10	52.83	0.68	—	—
Pleasanton									
Shale	—	13.70	50.24	5.66	17.14	6.04	2.20	—	—

Geological Conditions and Relations in Michigan

By R. A. SMITH

State Geologist, Michigan

The following facts on the physiographical and geological conditions and relations in Michigan, with particular reference to the formations used in the manufacture of cement and in allied industries, are excerpts from a paper presented before the Detroit Engineering Society, Detroit, March 26, 1926. Michigan has a number of portland cement plants and in addition supplies the principal raw material, limestone, for several other cement plants contiguous to the Great Lakes district, which makes the question of these geological formations of more than local interest.

The underlying hard rocks in Michigan have but slightly controlled the local topographic features in certain sections, though in other parts of the State their influence is very pronounced. The difference in hardness and resistance of the rock formations to erosion resulted in deep valleys and high ridges, though partly destroyed and almost wholly masked later by deposits of glacial drift. The basin of Lake Huron and Lake Michigan occupy areas underlain by formations composed of much soft rock. The eastern highland extending from the "Thumb" of Michigan southwestward into Ohio is in part due to a buried ridge of more resistant rock strata.

Apparently there were at least four major ice invasions but only the last two—the Illinoian and the Wisconsin—appear to have left recognizable evidences in Michigan.

The deposits during the Wisconsin period form a thick blanket over most of the State. The areas of thin drift are relatively very small in the Southern Peninsula. In most places the drift is from 50 to several hundred feet thick.

The successive ice invasions, with concomitant fluviatile agencies and certain diastrophic movements combined to completely change conditions. The fortuitous deposition of the glacial material resulted in innumerable basins of varying size. These, filled with water, made the tens of thousands of lakes of the glaciated region. Stream erosion and warping or differential uplift of the surface caused a most complicated series of changes in forms, levels, and outlets of the various great glacial lakes.

Limestone and Shales for Cement Manufacture

The completion of this long cycle of glaciation ended with the Great Lakes and the land surface essentially as at present. The final result is the most remarkable group of inland great lakes and system of fresh water transportation on the globe, strategically situated between the great iron and copper deposits of the Lake Superior district on the north and the Appalachian and central coal fields on the south and east adjacent to enormous deposits of pure limestone, practically inexhaustible deposits of rock salt and natural brines, clays and shales for ceramic building products, raw material for cement.

All of these rock formations are of Paleozoic Age. So far as known, no Triassic, Jurassic, Cretaceous or Tertiary deposits were laid down in Michigan. If they were, the long period of erosion extending to the Pleistocene, apparently half the length of the time scale, removed all traces of them. In fact a large part of the Paleozoic sediments were also removed for there is abundant evidence that many of the rock formations extended far beyond their present boundaries.

Hard Rock Geology

The hard rock strata form what is termed the Michigan Basin, a major geo-syncline about 500 miles across, extending from Lake Superior south into northern Ohio, and from central Wisconsin eastward into Ontario. The rock strata lie one upon the other like a nest of basins, butterbowls, or better, watch glasses, for the basins are relatively very shallow as compared with the width. Geologic evidence indicates that the bottom of the lowest basin is only about one and one-half miles below its brim. Each successively higher rock basin is smaller than the one below. The center or bottom of the basin is apparently in the region between Mount Pleasant and Midland.

Obviously in all the peripheral portions of the Michigan Basin the rock strata in general dip toward the geologic center of the Basin. The general dip of the beds, however, is always slight, usually being between 20 and 50 feet per mile, but locally the dip may be considerably more or less than the figure given. There may be a reversal of the general dip. These discordances are due to the gentle and usually very local warpings, or to initial deposition adjacent to coral reefs.

The upper central and smallest and shallowest basin is called the Saginaw Coal Basin. It is only about 150 miles across and 600 feet deep. The lowest and deepest is the Lake Superior or Cambrian sandstone, with a maximum diameter of about 500 miles, and a probable depth of more than 7,500 feet.

Geologic History—Pre-Cambrian Area

Nothing is definitely known as to the character of the Pre-Cambrian rock basement in the southern part of the State, upon which the Paleozoic sediments were deposited, but from deep borings in Ontario and extensive exposures of the basement around the northern sides of the Basin certain inferences may be warranted. It is probable that this basement is a great complex of rocks and rock formations including sediments and igneous rocks. These, however, are presumably in large part intricately folded, faulted, sheared, and metamorphosed into schists, slates, and gneisses, so that their original character and history are largely conjectural. In any case the basement complex includes some of the oldest rocks of the crust of the earth.

Paleozoic Geology

The Paleozoic era in Michigan began with the invasion of the sea in late Cambrian time from the south and west. This invasion left behind thick deposits now represented by the Lake Superior sandstone. The Cambrian seas were shallow, but deepening and clearing waters initiated the Ordovician era, characterized at first by sandy and limy deposits, then pure lime sediments, followed by muddy ones. These sediments are represented by the Beekmantown and St. Peter sandstones, the so-called "Trenton" limestone, and a group of shale formations, including the "Utica" or Eden black shale directly above the Trenton limestone, and a series of blue, gray, and green shales of the Lorraine and Richmond formations.

The Silurian sediments were sandy, limy, and muddy at first, but with clearing waters there was an extremely long and widespread deposition of pure limy sediments. These sediments gave rise to the most extensive limestone formations in the world. The sandy and muddy deposits are represented by the Cataract formation, and the lime sediments by the Niagaran group of limestones. After the close of the Niagaran period there was a long period of aridity with rapidly changing conditions of sedimentation. Limestones and shales, with beds of gypsum and salt were deposited, which now are known collectively as the Salina formation.

Following the Salina period there was a lessening of aridity but gypsum, now anhydrite, was deposited with lime and clayey and pure quartz sand sediment, now the Monroe of the Michigan section. The impure dolomites of the Upper and Lower Monroe beds, more properly called the Detroit River and Bass Island series, are of relatively small economic value, but the pure quartz sand deposit of the Middle Monroe or Sylvania is an important source of excellent glass sand.

In Michigan the Devonian sea deposited first pure lime sediments, now the Dundee limestone. Shallowing seas brought in clayey muds so that the next group of sediments was a series of clay and of lime muds and reefs, which in Michigan is known as the Traverse formation. The last part of the Devonian was a period in which there was deposited a great thickness of gray and black muds, now the Bedford-Antrim shale.

Largest Limestone Quarry in the World

The Dundee limestone underlies a narrow belt across the southeastern part of the Southern Peninsula. It is exposed only in three places in this part of the State and the most notable one is at Sibley quarry. It is chiefly composed of pure limestone; therefore is of great economic importance, especially in the northern part of the Southern Peninsula. The largest limestone quarry in the world is in the Dundee limestone near Rogers City, Presque Isle County.

There are a considerable number of exposures of Antrim shale between Grand Traverse and Thunder Bays in the northern part of the Southern Peninsula.

The Devonian period ended with an emergence of the land. This was followed by a period of erosion and another invasion of the sea. The deposits were sand on the eastern side of the State. This is the Berea sandstone and marks the beginning of the Mississippian age. This was followed by a great thickness of gray muds, now the Coldwater shale. At the end of the Coldwater period reddish muds, often sandy, were deposited, and these were followed by clear sand. The reddish muds and the overlying sand deposits are the Marshall formation.

The Berea always yields a strong pure brine and in many places small quantities of oil and gas. Recently commercially important quantities of oil have been found in it at Saginaw. The Coldwater shale is an important source of raw material for cement and is a potential source for ceramic products. Near the margin the Marshall formation yields large supplies of fresh water but nearer the center of the State it is the source of strong brine, characterized by its bromine content. Forty years ago the Marshall brines of Saginaw valley were the chief sources of salt, the manufacture of which was carried on in connection with the lumber industry. The brines are now the chief source of bromine in the United States.

The close of Mississippian was time of aridity. Beds of muddy limestone and pure gypsum were deposited. There was a clearing of the seas with a deposition of relatively pure limestone. The gypsum bearing group is called the Michigan series and the limestone formation the Bayport limestone.

Following the close of the Mississippian there was a long period of erosion in which the Bayport limestone was deeply dissected and much of it removed.

The last chapter of the Paleozoic was the deposition of beds of sandstone, shale, and coal, of the Pennsylvanian. This group in Michigan is the Saginaw formation. It is the source of a limited production of coal.

At the close of the Pennsylvanian there was a final emergence of the sea bottom. Never again was any part of Michigan or the Great Lakes region beneath the sea. During this enormous time the land surface was subjected to profound erosion. Paleozoic formations were completely removed from large areas beyond the present formation boundaries. Here and there a scattered outlier of some Paleozoic formation indicates its former extent.

Men and Mills

Notes from the Field

Blaine S. Smith Elected Vice-President of Universal Portland Cement Co.

Blaine S. Smith, who started as a salesman with the Universal Portland Cement Co. in 1908, from which he was advanced through various positions to that of general sales manager in 1915 and in which position he is credited with developing one of the most successful selling organizations in the country, was elected vice-president of the company at a meeting of its board of directors April 6. He also is president of the Portland Cement Association.

Blaine S. Smith, Vice-President, Universal Portland Cement Company

Photo by Moffett Studio

For many years Mr. Smith has been identified with the Chicago Association of Commerce as vice-president, member and chairman of various committees and member of the board of directors, which position he also fills on the Illinois Chamber of Commerce. He is a member of the American Society for Testing Materials, American Concrete Institute, Western Society of Engineers, U. S. Chamber of Commerce, Chicago Athletic Association, Union League Club and Exmoor Country Club.

The Universal Portland Cement Co. has plants at Chicago, Pittsburgh and Duluth, and recently purchased land for a new plant at Cleveland. General offices of the company are in Chicago, with district offices in Pittsburgh, Minneapolis, Duluth, Cleveland, Columbus and New York.

Forty-six employes of the Universal Portland Cement Co. of Duluth, Minn., members of the committee who won the safety bureau trophies for 1925, and who went through the entire year without loss of time through accident, were recently presented with gold watches at a banquet.

H. G. Jacobsen, Portland Cement Association, Chicago, Ill., John Ahnfelt, Chicago, and J. H. Kempster, general superintendent of the company's Buffington plant were guests at the banquet. R. S. Huey, general manager of the Duluth plant, was in charge of the arrangements.

After the completion of extensive improvements at the plant of the Lehigh Portland Cement Co. at Union Bridge, Md., operations were resumed early in April. This plant formerly owned by the Tidewater Portland Cement Co. is now plant No. 20 in the Lehigh chain of cement mills.

A 75-ton crane has been moved to the Gower tract on the Chestnut Ridge Hills, Monroe County, Pa., by the Atlas Portland Cement Co. The big machine will be used exclusively for taking off the topping of white clay and sand.

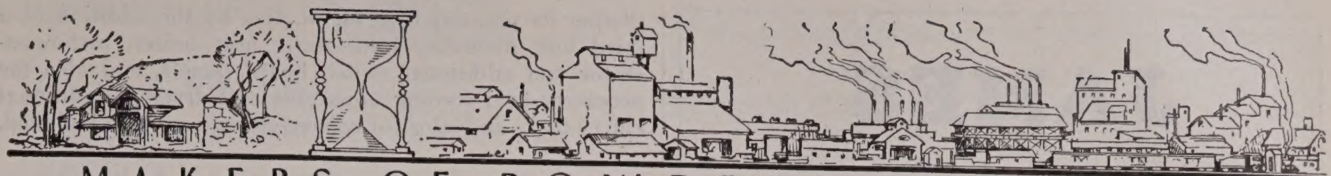
L. G. Peters, Nazareth, Pa., purchasing agent and superintendent for the Penn-Allen Cement Co. for the past 19 years, resigned on April 15, and has been made treasurer of the Nazareth Coal and Lumber Co., in which he has acquired an interest.

One workman was crushed to death and two others were seriously injured in the quarry of an eastern cement plant recently when the breaking of a cable allowed a skip loaded with rock to fall on a small building in which the four men were sheltered. The cable which broke was inspected daily, company officials stated.

The Atlas Portland Cement Co., has enlarged its holdings in the Saylorsburg section of Monroe County, Pa., by the purchase of a tract of about 300 acres. The purchase was made for the purpose of mining the clay of which there is a considerable quantity on the property.

The plant of the Hawkeye Portland Cement Co., located southwest of Des Moines, Iowa, was scheduled to resume operations early in April after a shut down of three months during which repairs were made. The plant, of which Ben Condon is general manager, employs about 300 men.

The Clinchfield Portland Cement Corporation is com-



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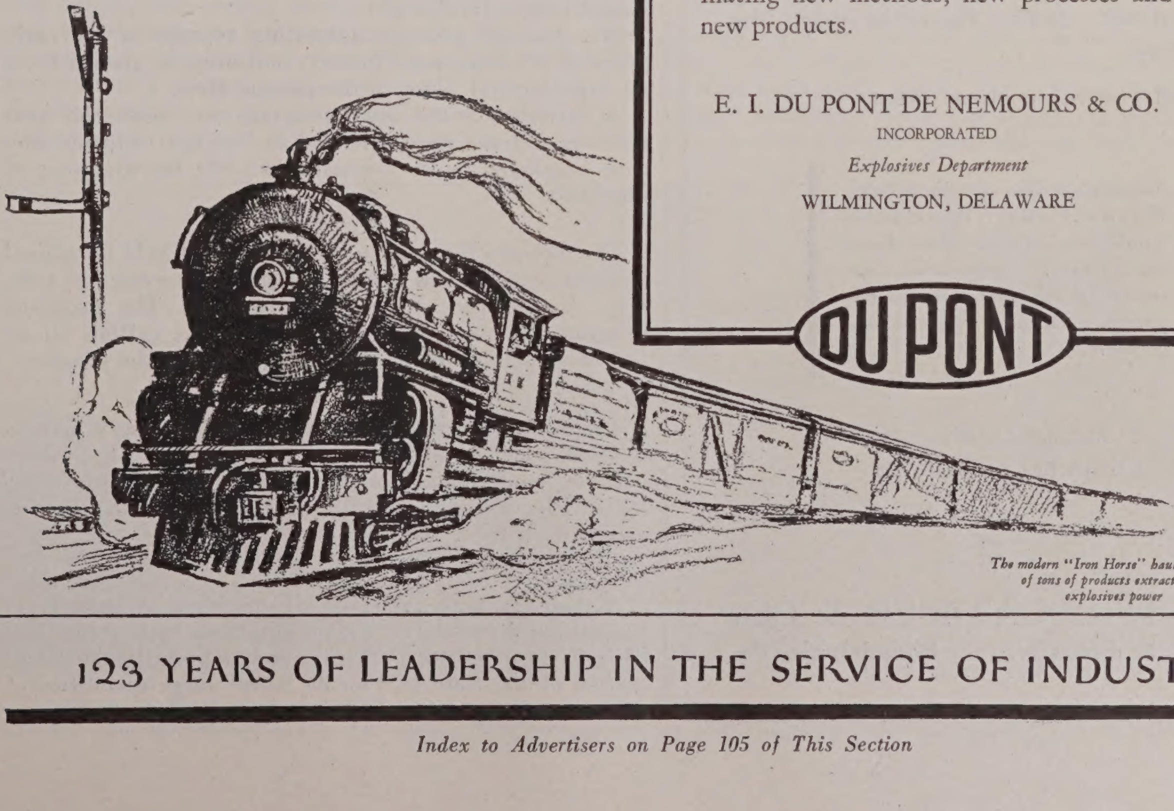

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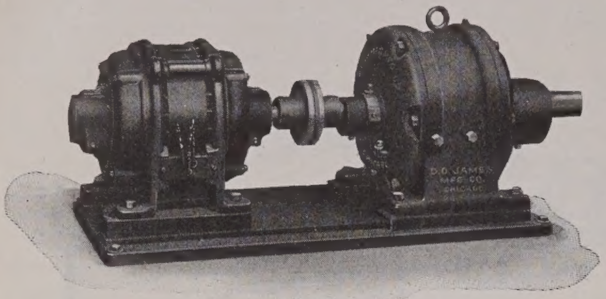

THE GO-BETWEEN

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ROBERT L. LATIMER & CO.
24 to 28 N. Front St. Philadelphia, Pa.

pleting its plant at Clinchfield, Ga., by the addition of a third unit including kiln, waste heat boiler, turbo-generator and additional switch board panels, and also the necessary coal feeding apparatus and dryers. Additional slurry tanks and silos for cement storage are also included.

The Pyramid Portland Cement Co., in preparation to resume full production of 3,000 bbls. of cement daily, started the raw mill recently and will employ approximately 100 men.

A large rock crusher, sufficient to handle a large quantity of commercial rock is to be installed by the Ash Grove Lime and Portland Cement Co., Missouri, at the plant west of Ash Grove.

The *Memphis Commercial Appeal* announces a report from Knoxville, Tenn., to the effect that a portland cement plant which will represent an investment of $2,000,000 is to be established just east of the Knoxville corporation line. Options are said to have been obtained on a tract of about 300 acres of land and tests made to determine the suitability of the raw materials for the manufacture of portland cement. The names of the organizers of the project are not given.

The tenth annual banquet of the Newago Portland Cement Co., given to company employes, was held in March, and nearly 200 guests were royally entertained. Following the serving of dinner, General Manager J. B. John lead the assemblage in a standing tribute to the late Charles H. McGregor, an old and faithful employe, whose death occurred since the banquet last year.

John J. Osthaus, toastmaster, called upon the general manager who spoke briefly outlining the plans and aims of the company for the coming year.

W. A. Ansorge, John Markert, Ralph Evans and George Monroe, all veteran employes, were presented with watches as a token of the esteem in which they are held by their employers. The watches were engraved with a record of each man's service, and Mr. John announced that every employe attaining a service record of 25 years will be presented with a similar gift.

Mr. Ansorge gave an interesting account of the early years of the company's history, outlining its growth from an experimental plant to the present time.

A variation in the usual program was made this year when invitations were extended to Newago residents who were employed by the company in 1899, the first year of operation.

The Newago Portland Cement Co. band held its annual banquet recently and elected officers for the ensuing year. Wm. A. Ansorge was elected president. The proposed program for the year is an ambitious one, calling for an increased number of public concerts during the summer.

The Lehigh Portland Cement Co. is building a demonstration concrete residence at Birmingham, Ala., which will be a modern and most attractive structure. This building will be one of four demonstration houses built by this company in the United States.

Alabama cement mills are all operating at capacity to supply the demand for cement for their local trade, and their trade in other southern states, especially the boom centers of the state of Florida where large quantities of cement are going into buildings, streets and roads.